



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/782,185	02/12/2001	Helen H. Zhu	LAM1P147/P0675	5391

22434 7590 08/05/2002

BEYER WEAVER & THOMAS LLP
P.O. BOX 778
BERKELEY, CA 94704-0778

EXAMINER

CHEN, KIN CHAN

ART UNIT	PAPER NUMBER
----------	--------------

1765

DATE MAILED: 08/05/2002

8

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/782,185	ZHU ET AL.	
	Examiner	Art Unit	
	Kin-Chan Chen	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 June 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4, 6 and 8-14 is/are pending in the application.
- 4a) Of the above claim(s) 15-18 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 6 and 8-14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Specification

1. The objection of the incorporation by reference of the pending U.S. Application No. 09/782,678, 09/782,446, and 09/782,437 is removed. However, if the referenced applications have not been issued as a patent when the current application is allowed, applicant is required to amend the disclosure to include the material incorporated by reference. The amendment must be accompanied by an affidavit or declaration stating the amendatory material consists of the same material incorporated by reference in the referencing application, MPEP 608.01(p).

Claim Rejections - 35 USC § 112

2. Claims 2-4, 6, and 12-14 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification.

In claim 2, line 2, "silicon-free benzocyclobutene" is new matter.

Claim 11 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 11 is rejected because the claim depends on the canceled claim 5.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1 and 2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tao et al. (US 6,194,128 B1; hereinafter "Tao") in view of Huang et al. (US 6,352,918 B1; hereinafter "Huang").

Tao teaches a method for etching a feature in an integrated circuit wafer, the wafer incorporating at least one low-k dielectric layer (col. 3, lines 20-24; col. 6, lines 20). Tao teaches that the wafer may be disposed within a reaction chamber. A flow of fluorocarbon-containing etchant gas may be introduced into the reaction chamber (col. 7, lines 57-61). A plasma may be formed from the etchant gas within the reaction chamber and the feature with at least a portion of the low-k dielectric layer may be etched (so-called etching the layer of low dielectric constant is performed in the MERIE in Tao, see col. 7, lines 57-58; col. 6, lines 25-28). Tao is not particular about the low-k dielectric layer. In a method of forming integrated circuits, Huang discloses that low-k dielectric, such as Flare, SILK, and PAE-II are **usually used** to reduce interconnection parasitic capacitance to reduce the RC delay and they are very popular IMD material (col. 1, lines 41-45). Hence, it would have been obvious to one with ordinary skill in the art to use SILK (so-called silicon-free low-k dielectric in claim 1 and silicon-free benzocyclobutene in claim 2) as low-k dielectric layer as taught by Huang because

Huang teaches that it is a well-known (**usually used**) low-k dielectric and using it will reduce interconnection parasitic capacitance and reduce the RC delay.

5. Claims 2-4, 6, 8-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tao et al. (US 6,194,128 B1) in view of Ye et al. (US 6,080,529) as evidenced by Huang et al. (US 6,352,918 B1; hereinafter "Huang").

Tao teaches a method for etching a feature in an integrated circuit wafer, the wafer incorporating at least one low-k dielectric layer (col. 3, lines 20-24). Tao teaches that the wafer may be disposed within a reaction chamber. A flow of fluorocarbon-containing etchant gas may be introduced into the reaction chamber (col. 7, lines 57-61). A plasma may be formed from the etchant gas within the reaction chamber and the feature with at least a portion of the low-k dielectric layer may be etched (so-called etching the layer of low dielectric constant is performed in the MERIE in Tao, see col. 7, lines 57-58; col. 6, lines 25-28).

As to dependent claim 2, Tao is not particular about the low-k dielectric layer used in his process, therefore, it would be obvious to one skilled in the art to use an organic low-k dielectric layer (such as SILK, so-called silicon-free benzocyclobutene in claim 2) because it is one of the well-known, most popular low-k dielectric layer in the art of semiconductor device fabrication. Ye is relied on to show this well-known feature (see col. 1, line 20). Hence, it would have been obvious to one with ordinary skill in the art to modify Tao by using this well-known organic low-k dielectric layer in order to provide their art recognized advantages and thus produce an expected result. The newly cited reference of Huang is also used as the evidence for the prior well-known

feature statement. Huang teaches that the dielectric layer with low dielectric constant (low-k), such as Flare, SILK, and PAE-II **are usually used** to reduce interconnection parasitic capacitance, to reduce the RC delay and they are very popular IMD material.

As to dependent claim 3, Tao teaches the fluorocarbon such as CHF_3 or CH_3F , see col. 7, line 58.

As to dependent claim 4, Tao teaches the additives such as oxygen or nitrogen, see col. 7, line 58.

As to dependent claim 6, Tao teaches that the flow rate of fluorocarbon may be 5 to 15 sccm (col. 7, line 61), which is within the range cited.

As to dependent claims 8 and 9, Tao teaches that the fluorocarbon-containing etchant gas may comprise CH_3F and nitrogen (col. 7, line 58). Unlike the claimed invention, Tao does not teach that hydrogen (instant claim 8) and NH_3 (instant claim 9) may be included. Ye teaches that the hydrogen/ nitrogen based plasma (such as ammonia; or hydrogen and nitrogen) is especially useful for etching organic low-k dielectric in a multiplayer substrate (col. 6, lines 23-27 and 65; col. 7, lines 14-15). Hence, it would have been obvious to one with ordinary skill in the art to modify Tao by including hydrogen and / or ammonia plasma as taught by Ye because Ye teaches that it is especially useful for etching organic low-k dielectric in a multiplayer substrate. (C.G.L. 269)

As to dependent claim 10, Tao teaches that the fluorocarbon-containing etchant gas may comprise CH_3F gas, O_2 gas and N_2 gas (col. 7, line 58).

As to dependent claim 11, Tao teaches that the flow rate of fluorocarbon may be 5 to 15 sccm (col. 7, line 61), which is within the range cited.

As to dependent claims 12 and 13, Tao teaches that the fluorocarbon-containing etchant gas may comprise CH_3F and nitrogen (col. 7, line 58). Unlike the claimed invention, Tao does not teach that hydrogen (instant claim 12) and NH_3 (instant claim 13) may be included. Ye teaches that the hydrogen/ nitrogen based plasma (such as ammonia; or hydrogen and nitrogen) is especially useful for etching organic low-k dielectric in a multiplayer substrate (col. 6, lines 23-27 and 65; col. 7, lines 14-15). Hence, it would have been obvious to one with ordinary skill in the art to modify Tao by including hydrogen and / or ammonia plasma as taught by Ye because Ye teaches that it is especially useful for etching organic low-k dielectric in a multiplayer substrate.

As to dependent claim 14, Tao teaches that the fluorocarbon-containing etchant gas may comprise CH_3F gas, O_2 gas and N_2 gas (col. 7, line 58).

Response to Arguments

6. Applicant's arguments filed on June 11, 2002 have been fully considered but they are not persuasive.

Applicant argues that Tao does not teach silicon-free low-k dielectric (SILK). In fact, Tao teaches carbon based (organic) low-k dielectric and cited examples such as Flare and PAE-II in one preferred embodiment, as stated in the office action, Tao is not particular about the low-k dielectric layer (col. 3, lines 20-24; col. 6, lines 20) used in the invention, and Huang teaches that the dielectric layer with low dielectric constant (low-k), such as Flare, SILK, and PAE-II **are usually used** to reduce interconnection

parasitic capacitance and reduce the RC delay and they are very popular IMD material. Hence, it would have been obvious to one with ordinary skill in the art to use SILK (so-called silicon-free low-k dielectric in claim 1 and silicon-free benzocyclobutene in claim 2) as low-k dielectric layer.

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

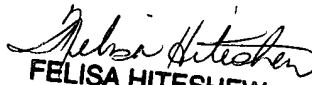
8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kin-Chan Chen whose telephone number is (703) 305-0222. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on (703) 308-3836. The fax phone

Art Unit: 1765

numbers for the organization where this application or proceeding is assigned are (703) 305-5408 for regular communications and (703) 872-9311 for After Final communications. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-2934.

K-C C

July 25, 2002


FELISA HITESHEW
PRIMARY EXAMINER
Art 1765